



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/529,535	03/29/2005	Pyung-Yong Um	JO 01915	4563
27667	7590	06/15/2006	EXAMINER	
HAYES, SOLOWAY P.C. 3450 E. SUNRISE DRIVE, SUITE 140 TUCSON, AZ 85718			ABRAMOWITZ, HOWARD E	
			ART UNIT	PAPER NUMBER
			1762	

DATE MAILED: 06/15/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/529,535

Applicant(s)

UM, PYUNG-YONG

Examiner

Howard E. Abramowitz

Art Unit

1762

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 17 April 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 6-10 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 6-10 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Amendment

Applicant's amendments filed 4/17/06, have been fully considered and reviewed by the examiner. The examiner notes that claims 1-5 have been canceled and claims 6-10 have been added. Currently claims 6-10 are pending in the application.

Response to Arguments

Applicant's arguments, see remarks, filed 4/17/06, with respect to claims 1-5 have been fully considered and are persuasive. The 102 rejection of the claims has been withdrawn. The new claims limitations require that the 102 rejection be removed as the limitation that the ammonia to silane gas flow rate ratio be different is not taught explicitly by the prior art.

Applicant's arguments filed 4/17/06 have been fully considered but they are not persuasive. The applicant has argued that the examiner's assertion that the thickness at the upper region is inherently larger than that at the sides and bottoms is not true.

The examiner points to the Abe Reference (US Patent Application Publication No. 2002/0061659) to rebut these arguments. This reference clearly teaches that the thickness of the top layer is greater than that of the sides and bottom when forming silicon nitride films by conventional CVD methods (figure 9, paragraphs 9-13). It teaches that this feature occurs due to the shadowing effect (paragraph 16). In fact the entire Abe reference is devoted to trying to limit the formation of the shadowing effect and create a film where the thickness at the top is the same as the thickness on the

Art Unit: 1762

sides and bottom. Thus the reference is devoted to avoiding the goal of the applicant's invention by eliminating the feature that conventionally occurs. Of note is that despite their best efforts they could not create a film where the thickness of the top layer was equal to the thickness of the bottom side layers. While they did come close (paragraph 43, figure 4), at no point did they actually reach the limitation where the thickness of the film at the sides was equal to or greater than the thickness on the top. Accordingly one of ordinary skill would reason from this that it is an inherent property that the thickness of the film is greater on the top than on the sides and bottom and that while it is possible to control the ratio of the two thicknesses it was not found possible to actually make the two thicknesses equal or have the side thickness greater than the top thickness. Accordingly from the teachings of Abe one of ordinary skill would not be able to reason a method of depositing a film where the thickness of the top layer is less than or equal to the thickness of the side layer, therefore the Sato et al. reference while silent as to the thickness of the side and bottom relative to the top would have to have the conventional property that the thickness is greater in the top region than in the sides and bottom as this feature is inherent as taught by Abe.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 6-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sato et al. (US Patent Application Publication No. 2002/0048971).

Referring to claim 6, Sato et al. discloses a method for depositing a nitride film using a chemical vapor deposition apparatus of a single chamber type comprising a process chamber comprising an inlet gas line through which process gases are introduced; a showerhead for spraying the introduced process gases; a heater on which the wafer is placed and a vacuum port for discharging the process gases (paragraphs 74 and 75, figure 5) the method including;

Depositing a first nitride film by performing a first nitride film deposition process while a mixture ratio of ammonia gas and silane gas, which are the process gases, injected in order to first deposit the nitride film is maintained at 100:1 (paragraphs 93 and 94). depositing a first nitride film by performing a first nitride film deposition process while a mixture ratio of ammonia gas and silane gas, which are the process gases, injected in order to first deposit the nitride film is maintained in 100:1 or more (paragraphs 93 and 94) and;

Depositing a second nitride film in situ at a different flow rate ratio of ammonia to silane (paragraph 26). It does not teach specifically to use a ratio of 100:1 or less in the second deposition process. However, Sato et al. teaches that the ratio of ammonia to silane adjusts the ratio of the thickness of the silicon nitride film deposited in a high gate-electrode-pattern density region to the thickness of the silicon nitride film deposited in a low density region (paragraph 93) and is open to the possibility that the ratio is less than 100:1. Therefore the ammonia to silane ratio is a result effective parameter in that

Art Unit: 1762

it effects the thickness ratio of the silicon nitride film deposited in different regions. It would have been obvious to have adjusted the ratio of the ammonia to silane gas to values in the claimed ranges through routine experimentation so as to optimize the ratio of the film thickness in a high gate-electrode-pattern density region to the thickness of the silicon nitride film deposited in a low density region, especially in the absence of a showing of a criticality for using values in the claimed ranges.

Referring to claims 7-10 Sato et al. discloses an example where the silicon nitride layer is deposited with the process conditions: silane flow 20 sccm, ammonia flow 1400 sccm, nitrogen flow 3600 sccm, a pressure of 275 torr, and a temperature of 750 °C (paragraph 78).

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

Art Unit: 1762

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.


Any inquiry concerning this communication or earlier communications from the examiner should be directed to Howard E. Abramowitz whose telephone number is 571-272-8557. The examiner can normally be reached on monday-friday 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy H. Meeks can be reached on 571-272-1423. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.



HEA



TIMOTHY MEEKS
SUPERVISORY PATENT EXAMINER